Before the
FEDERAL COMMUNICATIONS COMMISSION
Washington, D.C. 20554

In the Matter of	)	
	)	
Aeronet Global Communications Inc.'s	)	RM-11824
Petition for Rulemaking to Amend	)	
the Commission's Allocation and Service Rules	)	
for the 71-76 GHz, 81-86 GHz, and 92-95 GHz	)	
Bands to Authorize Aviation Scheduled	)	
Dynamic Datalinks	)	
	)	
Aeronet Global Communications Inc.'s	)	RM-11825
Petition for Rulemaking to Amend	)	
the Commission's Allocation and Service Rules	)	
for the 71-76 GHz, 81-86 GHz, and 92-95 GHz	)	
Bands to Authorize Maritime Scheduled	)	
Dynamic Datalinks	)	

COMMENTS OF SIERRA NEVADA CORPORATION

Sierra Nevada Corporation ("SNC") submits these comments opposing the above-captioned Petitions by Aeronet Global Communications Inc. ("Aeronet") to modify the Federal Communications Commission's ("FCC" or "Commission") rules for Part 101 operations in the 70/80/90 GHz frequency bands.[1/] Aeronet's requests are a major departure from the Commission's rules and Aeronet has not demonstrated that its proposed system can operate without causing interference to other users.

[1/] *Aeronet Global Communications Inc.'s Petition for Rulemaking to Amend the Commission's Allocation and Service Rules for the 71-76 GHz, 81-86 GHz, and 92-95 GHz Bands to Authorize Aviation Scheduled Dynamic Datalinks*, Petition for Rulemaking of Aeronet Global Communications Inc., RM-11824 (Feb. 6, 2019) ("*Aviation Petition*"); *Aeronet Global Communications Inc.'s Petition for Rulemaking to Amend the Commission's Allocation and Service Rules for the 71-76 GHz, 81-86 GHz, and 92-95 GHz Bands to Authorize Maritime Scheduled Dynamic Datalinks*, Petition for Rulemaking of Aeronet Global Communications Inc., RM-11825 (Feb. 6, 2019) ("*Maritime Petition*") (together, the "*Aeronet Petitions*").

More than a year ago, SNC requested that the Commission initiate a rulemaking proceeding to allow Part 87 radar to operate in the 90 GHz frequency range for Enhanced Flight Vision Systems ("EFVS").[2/] SNC therefore has an interest in the 90 GHz spectral environment, and is concerned about the potential impact of Aeronet's proposals. The Commission should not act on Aeronet's requested rule changes absent adequate information and assurance that the proposed system can adequately co-exist with other users, including EFVS.

I. BACKGROUND

Sierra Nevada Corporation, established in 1963 and headquartered in Sparks, Nevada, is a privately owned and operated company focused on aerospace, aviation, system integration, and electronics. SNC has numerous fielded systems operating throughout the world by both private and public entities, and currently is developing the Dream Chaser spaceplane to deliver cargo to the International Space Station.

For nearly a decade, SNC has been developing a radar-based EFVS that would allow for landings of fixed and rotary wing aircraft during Degraded Visual Environments ("DVEs"), such as brownouts, sandstorms, snowstorms, and other poor visibility conditions.[3/] On February 16, 2018, SNC filed a Petition for Rulemaking ("Petition") requesting that the Commission modify Part 87 of its rules to allow EFVS radar operations in the 92-95.5 GHz frequency range.[4/] No party opposed this request.[5/]

2/ *Amendment of the Commission's Rules to Allow for Enhanced Flight Vision System Radar under Part 87*, Petition of Sierra Nevada Corporation for Rulemaking, Docket No. RM-11799 (filed Feb. 16, 2018) ("SNC Petition").

3/ SNC has been testing this system under FCC experimental authority.

4/ SNC Petition.

5/ *See generally Amendment of the Commission's Rules to Allow for Enhanced Flight Vision System Radar under Part 87*, Docket No. RM-11799 (demonstrating the absence of filings in opposition).

There are no commercial solutions that allow for aircraft landings in moderate to severe DVE conditions.[6/] Current EFVS technologies are based on infrared camera sensors, which have proven to be inadequate because infrared wavelengths are near the visible spectrum. Adding mmWave radar to EFVS systems redresses this problem, allowing pilots to "see" through heavily degraded visual conditions. The FAA has determined that providing pilots with this capacity benefits the public as it "should increase access, efficiency, and throughput at many airports when low visibility is a factor,"[7/] and "[i]nterrupted flight operations due to low visibility result[s] in lost passenger time and extra fuel consumption."[8/]

As SNC detailed in its Petition, the 90 GHz band is ideal for short range EFVS radar for several reasons. Using mmWave radar provides for the best overall technological solution to achieving deep penetration with moderate resolution in nearly all visual obscurants. From a physical perspective, 90 GHz is the optimal frequency range to use to maximize obscurant penetration and radar angular resolution. Other frequency ranges are less optimal. For example, a lower frequency range often used by traditional radar systems (*e.g.*, the X-band, approximately 10 GHz) allows for very deep penetration, but resolution would be an order of magnitude worse; these radar could not be used to resolve runways and other objects at required ranges.

6/ SNC Petition at 2.

7/ Federal Aviation Administration, *Revisions to Operational Requirements for the Use of Enhanced Flight Vision Systems (EFVS) and to Pilot Compartment View Requirements for Vision Systems*, Final Rule, 81 Fed. Reg. 90126 (Dec. 13, 2016). The FAA, which regulates aircraft airworthiness and operations, has issued rules and guidances on when and how EFVS may be used during approach operations. *See* 14 C.F.R. § 95.175 (instrument flight landing requirements) and Federal Aviation Administration, *Enhanced Flight Vision Systems*, Advisory Circular 90-106A (Mar. 2, 2017).

8/ *See* Federal Aviation Administration, *Revisions to Operational Requirements for the Use of Enhanced Flight Vision Systems (EFVS) and to Pilot Compartment View Requirements for Vision Systems*, Notice of Proposed Rulemaking, 78 Fed. Reg. 34935, 34949 (June 11, 2013).

Permitting 90 GHz radar for EFVS will allow for numerous public benefits, including:

- Supporting the goals of the FAA's NextGen Implementation Plan, which seeks to improve aircraft approaches and landings, as well as other flight operations;[9/]
- Providing access to a greater number of airports and runways when visibility is low;[10/]
- Eliminating airport ground infrastructure used for landings and approaches, which is costly to deploy and maintain;
- Decreasing the number of redirected and/or delayed flights, thereby improving airport efficiencies and reducing aircraft operational costs;[11/] and
- Improving the environmental impact of flights by reducing the use of fuel when aircraft are kept in holding patterns or need to be rerouted, and potentially limiting flights over environmentally sensitive areas.[12/]

Given these many public benefits that would be achieved *via* EFVS technology, SNC urges the Commission to consider Aeronet's proposed changes to the use of the 90 GHz band in light of the rule changes being proposed by SNC.

II. DISCUSSION

Aeronet seeks modifications to the Part 101 rules for 70/80/90 GHz to allow transmissions from ground terminals to airplanes and ships; between airplanes in flight and between ships in transit; through aerostat or drone relay stations located in the air; and for other uses.[13/] While Aeronet characterizes its requests as modest departures from the rules, the transmission of high power signals to and between moving end points, at directions not in the horizontal plane, is a much different use of spectrum from the fixed point-to-point microwave operations currently allowed under Part 101. Additionally, Aeronet's proposal lacks technical support for its claims

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9/ Federal Aviation Administration, *NextGen Implementation Plan 2016*, at 38-41 (2016), https://www.faa.gov/nextgen/media/NextGen_Implementation_Plan-2016.pdf.

10/ *Id*. at 39.

11/ *Id*.

12/ *Id*.

13/ Aviation Petition at 13-16; Maritime Petition at 11-13, 26.

that its systems can successfully co-exist with other users. For these reasons, grant of the requests would not be in the public interest.

A. **Aviation and Maritime Scheduled Dynamic Datalinks are Not Fixed Services and Commission Precedent Does Not Support a Major Departure from Part 101 Rules**.

Aeronet asserts that it is only seeking "minor" modifications to Part 101.[14/] However, providing transmissions into the air at long range to airplanes and aerostats or drones is substantially different from typical point-to-point microwave operations, especially given that the Part 101 rules contemplate the use of directional antennas "in the horizontal plane."[15/] Aeronet describes its system as having multiple data links steered across the sky from any one ground station to "endpoints that are in motion."[16/] In fact, Aeronet states that "aircraft could function as cell towers in the sky,"[17/] and indicates that other use cases for its system, such as service to wind farms or rural areas, could be possible.[18/] Aeronet's request is a substantial departure from the regulatory scheme contemplated by the Commission for the 70/80/90 GHz bands, which were established for high power fixed links and low power mobile connectivity.

Aeronet relies upon the Commission's Earth Stations in Motion ("ESIMs") precedent, a reliance that is misplaced.[19/] The Commission's ESIM rules allowing for connectivity between earth stations on board aircraft and FSS space stations stem from years of discussion, study and comments that took place at the International Telecommunications Union, in particular during the 2003 and 2015 World Radiocommunication Conferences.[20/] In contrast, here there have been no

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14/ Aviation Petition at 28; Maritime Petition at 22, 25.
15/ *See* 47 C.F.R. § 101.115.
16/ Aviation Petition at 4, 13.
17/ *Id.* at 18.
18/ *Id.*
19/ *See* Aviation Petition at 31; Maritime Petition at 30.
20/ *See* Resolution 902 (WRC-03); *see also Amendments of Parts 2 and 25 of the Commission's Rules to Facilitate the Use of Earth Stations in Motion Communicating with*

such studies done. As well, Part 25 contains requirements to ensure accurate antenna pointing by ESIMs (whether *via* antenna accuracy requirements and/or off-axis EIRP limits, coupled with certain shutdown requirements) to protect other users.[21/] In contrast, the Part 101 regulatory regime instead relies on prior coordination of links though a spectrum coordinator to manage the spectral environment, a system not designed to manage high power transmissions to multiple moving end points.

For these reasons, Aeronet's proposed use of Part 101 requires substantial study and analysis, and the ESIM rules do not provide helpful precedent for Aeronet's requested rule changes.

B. **Aeronet's Request Lacks Technical Support that the Proposed Rule Changes Will Not Cause Interference to Other Users**.

The 90 GHz band presently is allocated on a co-primary basis for Federal and non-Federal fixed, mobile, radio astronomy and radiolocation use. Presently, only one FCC equipment certification grant for 90 GHz has been issued, for a Part 15 sensor. On the Federal side, 90 GHz is used for CloudSat, radio astronomy, and federal radar operations.[22/] SNC's requested modification to Part 87 of the Commission's rules would allow the operation of EFVS 90 GHz radar as Aircraft Stations, similar to other airborne radar systems allowed today.[23/]

The Commission should ensure that sufficient information is provided in the record to allow parties to analyze the potential interference effects of Aeronet's proposal. SNC is

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Geostationary Orbit Space Stations in Frequency Bands Allocated to the Fixed Satellite Service, Notice of Proposed Rulemaking, 32 FCC Rcd 4239, 4241, n.7 (2017) ("*ESIM NPRM*").

21/ *See ESIM NPRM* at §§ 22-27.

22/ SNC has proposed in its Petition that all Part 87 EFVS radar be required to meet the NTIA's radar requirements to assure co-existence between Federal and non-Federal radar systems. SNC Petition at 15.

23/ SNC Petition at 10.

particularly concerned about Aeronet's proposed links aimed to the sky (between ground stations and airplanes, and ground stations and aerostats or drones). These transmissions may have potentially harmful effects on both fixed and rotary wing use of EFVS. Transmissions from the ground to airplanes located at altitudes of 10,000 to 50,000 feet are much longer range than what would occur with ground-based links in 90 GHz. Additionally, the transmissions will be focused in unpredictable directions with wide areas of transmission. (The interference zone would be near omni-directional for any given ground station). This is especially true given the apparently very sparsely populated proposed ground stations envisioned with the Aeronet system – aircraft would need to be tracked by the ground stations over wide expanses of their routes. For these reasons, the operational footprint of Aeronet's proposed network would be drastically different from what is currently allowed under Part 101.

EFVS radar would not be able to co-exist with such dynamic, ground-to-air (and vice versa) links operating at long distances. It might be that the Aeronet system and EFVS use on fixed wing aircraft at known airport sites could be coordinated. However, given the relatively wide area of Aeronet operations and the very large number of private and public airports affected, this coordination would be difficult and severely limit the usability of both the Aeronet and EFVS systems. The impact of Aeronet's proposal on the use of EFVS on rotary craft, such as by state and local law enforcement search and rescue helicopters, is especially concerning. These operations could occur virtually anywhere, and the wide net cast by the Aeronet ground-to-air links would almost certainly interfere with these operations.

With regard to Aeronet's proposed air-to-air links, if operations occur only at altitudes of 10,000 to 50,000 feet,[24/] it may be that no interfering energy would spill below 10,000 feet and that other users of the spectrum may not impacted. Information would need to be provided regarding the sidelobes from the planned beams to clarify that potential interfering energy would be contained at or above 10,000 feet altitude. However, it is possible that Aeronet's 90 GHz links retaining emissions between 10,000 and 50,000 feet altitude may be able to co-exist with 90 GHz EFVS radar.

C. **Aeronet's Request, as it Stands, is Not in the Public Interest**.

The Commission should be cautious that it does not hamper technological development by allowing one type of operation that would preclude other technologies, especially in bands designed for sharing. As Aeronet notes, the FCC's regulatory regime for the E-band was designed for flexible use, to allow for new technical innovations.[25/] While service rules presently exist only for Parts 15 and 101 operations, the 90 GHz band is allocated for additional uses, including radiolocation.

Therefore, one important consideration is the commercial production of chipsets and key components for high resolution imaging radars that will be used in the United States, including for EFVS.[26/] These technologies have coalesced around the 90 GHz band, generally designed to operate with a center frequency at 94 GHz and for bandwidths of up to 4 GHz, equating to an

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24/ Though not entirely clear, it appears from Aeronet's filing that its ground stations would not transmit to aircraft until the aircraft reached an altitude of 10,000 feet. *See* Aviation Petition at 14. Aeronet's Petition also states elsewhere, however, that the air-to-air links would occur "above a minimum altitude." Aviation Petition at 20. The maritime relay stations would be flown "below 1,000 feet of elevation," Maritime Petition at 26, which would be problematic to EFVS used by rotary aircraft.

25/ *See* Aviation Petition at 26.

26/ Key components for high resolution radar include power amplifiers (for transmitters) and low noise amplifiers (for receivers) specifically matching the frequencies of operation.

average frequency range of 92-96 GHz. There are no commercially available standard chipsets or components suitable for high resolution imaging radars for operations below 92 GHz or above 96 GHz.[27/] The Commission should consider Aeronet's request with the understanding that chip and component manufacturers are designing imaging radar products for the 90 GHz band.

III. CONCLUSION

The 90 GHz band is uniquely well suited for short range radar systems that can penetrate degraded visual environments. Chip and parts manufacturers have coalesced the design of their short range mmWave radar technologies around the 90 GHz band, specifically 92-96 GHz. Given the development of this available equipment and technology, as well as SNC's requested rule change – which promotes the FAA's Next Generation system goals – the FCC should assure that deployment of EFVS radar in 90 GHz may occur in conjunction with any rule change made to allow new services within this frequency range.

Respectfully submitted,

Laura Stefani
Mintz, Levin, Cohn, Ferris, Glovsky and Popeo, PC
701 Pennsylvania Ave., N.W.
Suite 900
Washington, DC 20004
(202) 434-7387
Counsel for Sierra Nevada Corporation

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27/ *See* SNC Petition at 7.